Code No: 07A52101 **R07** **Set No. 2**

III B.Tech I Semester Examinations,December 2011
FLIGHT MECHANICS-I
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. In steady and level flight, derive the expression for Velocity of airplane and lift coefficient for minimum thrust or drag. [16]

2. (a) Derive an equation for the minimum level speed achievable by a reciprocating engine propeller driven low subonic airplane. Assume a constant parabolic drag polar and that the variation of the power as directly proportional to density ratio at altitude, but invariant with Mach number of flight.
   (b) Discuss the variation of minimum level speed with wing loading and P/W ratio (specified at sea level), for the airplane.
   (c) Obtain an equation for the absolute ceiling of the airplane. [8+4+4]

3. (a) Name two devices each that may significantly improve the following aerodynamic characteristics of a wing, and describe how.
      i. Increasing maximum lift coefficient
      ii. Increasing stalling angle of attack
      iii. Decreasing minimum drag coefficient.
   (b) Name two geometric parameters of a wing (other than those of the wing section) that most significantly affect its 'pitching moment coefficient at zero lift' and describe how. [12+4]

4. (a) Classify the different flight regimes in terms of Mach number with neat sketches.
   (b) What are the flow conditions before and after a normal shock wave? Draw neat sketches. [8+8]

5. (a) What is a rocket? What are the different types of rockets?
   (b) Explain the working of a pressure feed liquid propellant engine with a neat sketch. [8+8]

6. Using Newton's second law of motion derive L (roll moment), M (pitch moment) and N (yawing moment) for an aircraft. [16]

7. (a) Assuming that the thrust is much larger than the drag and ground friction on the aircraft during take off, estimate the percentage of the total increase (or decrease) of the distance of ground roll for take off on account of 1% increase each in the
      i. Take off weight, and
      ii. Maximum lift coefficient of the aircraft.

(b) Name the parameters (design and operating) that limit the maximum rate of turn of an airplane in

i. Sustained level turns and in

ii. Instantaneous or descending turns, and in

iii. Steady climbing turns. Describe how. [8+8]

8. (a) The power required to generate a thrust of T at a flight speed V by a propeller is 3200kW. Using momentum theory, determine the power required to generate the same thrust and at the same flight speed if the diameter of the propeller is increased by 30%.

(b) Discuss the effect of Mach number on the lift dependent drag of a high aspect ratio wing. [12+4]

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Code No: 07A52101 **R07** **Set No. 4**

III B.Tech I Semester Examinations,December 2011
FLIGHT MECHANICS-I
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) The power required to generate a thrust of T at a flight speed V by a propeller is 3200kW. Using momentum theory, determine the power required to generate the same thrust and at the same flight speed if the diameter of the propeller is increased by 30%.
   (b) Discuss the effect of Mach number on the lift dependent drag of a high aspect ratio wing. [12+4]

2. (a) Assuming that the thrust is much larger than the drag and ground friction on the aircraft during take off, estimate the percentage of the total increase (or decrease) of the distance of ground roll for take off on account of 1% increase each in the
      i. Take off weight, and
      ii. Maximum lift coefficient of the aircraft.
   (b) Name the parameters (design and operating) that limit the maximum rate of turn of an airplane in
      i. Sustained level turns and in
      ii. Instantaneous or descending turns, and in
      iii. Steady climbing turns. Describe how. [8+8]

3. (a) What is a rocket? What are the different types of rockets?
   (b) Explain the working of a pressure feed liquid propellant engine with a neat sketch. [8+8]

4. (a) Name two devices each that may significantly improve the following aerodynamic characteristics of a wing, and describe how.
      i. Increasing maximum lift coefficient
      ii. Increasing stalling angle of attack
      iii. Decreasing minimum drag coefficient.
   (b) Name two geometric parameters of a wing (other than those of the wing section) that most significantly affect its 'pitching moment coefficient at zero lift' and describe how. [12+4]

5. Using Newton's second law of motion derive L (roll moment), M (pitch moment) and N (yawing moment) for an aircraft. [16]

6. (a) Classify the different flight regimes in terms of Mach number with neat sketches.

(b) What are the flow conditions before and after a normal shock wave? Draw neat sketches. [8+8]

7. (a) Derive an equation for the minimum level speed achievable by a reciprocating engine propeller driven low subonic airplane. Assume a constant parabolic drag polar and that the variation of the power as directly proportional to density ratio at altitude, but invariant with Mach number of flight.

(b) Discuss the variation of minimum level speed with wing loading and P/W ratio (specified at sea level), for the airplane.

(c) Obtain an equation for the absolute ceiling of the airplane. [8+4+4]

8. In steady and level flight, derive the expression for Velocity of airplane and lift coefficient for minimum thrust or drag. [16]

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Code No: 07A52101 **R07** **Set No. 1**

III B.Tech I Semester Examinations,December 2011
FLIGHT MECHANICS-I
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive an equation for the minimum level speed achievable by a reciprocating engine propeller driven low subonic airplane. Assume a constant parabolic drag polar and that the variation of the power as directly proportional to density ratio at altitude, but invariant with Mach number of flight.
   (b) Discuss the variation of minimum level speed with wing loading and P/W ratio (specified at sea level), for the airplane.
   (c) Obtain an equation for the absolute ceiling of the airplane. [8+4+4]

2. (a) Name two devices each that may significantly improve the following aerodynamic characteristics of a wing, and describe how.
      i. Increasing maximum lift coefficient
      ii. Increasing stalling angle of attack
      iii. Decreasing minimum drag coefficient.
   (b) Name two geometric parameters of a wing (other than those of the wing section) that most significantly affect its 'pitching moment coefficient at zero lift' and describe how. [12+4]

3. (a) What is a rocket? What are the different types of rockets?
   (b) Explain the working of a pressure feed liquid propellant engine with a neat sketch. [8+8]

4. In steady and level flight, derive the expression for Velocity of airplane and lift coefficient for minimum thrust or drag. [16]

5. (a) Assuming that the thrust is much larger than the drag and ground friction on the aircraft during take off, estimate the percentage of the total increase (or decrease) of the distance of ground roll for take off on account of 1% increase each in the
      i. Take off weight, and
      ii. Maximum lift coefficient of the aircraft.
   (b) Name the parameters (design and operating) that limit the maximum rate of turn of an airplane in
      i. Sustained level turns and in
      ii. Instantaneous or descending turns, and in
      iii. Steady climbing turns. Describe how. [8+8]

6. (a) Classify the different flight regimes in terms of Mach number with neat sketches.
   (b) What are the flow conditions before and after a normal shock wave? Draw neat sketches. [8+8]

7. (a) The power required to generate a thrust of T at a flight speed V by a propeller is 3200kW. Using momentum theory, determine the power required to generate the same thrust and at the same flight speed if the diameter of the propeller is increased by 30%.
   (b) Discuss the effect of Mach number on the lift dependent drag of a high aspect ratio wing. [12+4]

8. Using Newton's second law of motion derive L (roll moment), M (pitch moment) and N (yawing moment) for an aircraft. [16]

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Code No: 07A52101 **R07** **Set No. 3**

III B.Tech I Semester Examinations,December 2011
FLIGHT MECHANICS-I
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Assuming that the thrust is much larger than the drag and ground friction on the aircraft during take off, estimate the percentage of the total increase (or decrease) of the distance of ground roll for take off on account of 1% increase each in the
   i. Take off weight, and
   ii. Maximum lift coefficient of the aircraft.
   (b) Name the parameters (design and operating) that limit the maximum rate of turn of an airplane in
   i. Sustained level turns and in
   ii. Instantaneous or descending turns, and in
   iii. Steady climbing turns. Describe how. [8+8]

2. Using Newton's second law of motion derive L (roll moment), M (pitch moment) and N (yawing moment) for an aircraft. [16]

3. In steady and level flight, derive the expression for Velocity of airplane and lift coefficient for minimum thrust or drag. [16]

4. (a) What is a rocket? What are the different types of rockets?
   (b) Explain the working of a pressure feed liquid propellant engine with a neat sketch. [8+8]

5. (a) Classify the different flight regimes in terms of Mach number with neat sketches.
   (b) What are the flow conditions before and after a normal shock wave? Draw neat sketches. [8+8]

6. (a) The power required to generate a thrust of T at a flight speed V by a propeller is 3200kW. Using momentum theory, determine the power required to generate the same thrust and at the same flight speed if the diameter of the propeller is increased by 30%.
   (b) Discuss the effect of Mach number on the lift dependent drag of a high aspect ratio wing. [12+4]

7. (a) Name two devices each that may significantly improve the following aerodynamic characteristics of a wing, and describe how.
   i. Increasing maximum lift coefficient
   ii. Increasing stalling angle of attack

iii. Decreasing minimum drag coefficient.

(b) Name two geometric parameters of a wing (other than those of the wing section) that most significantly affect its 'pitching moment coefficient at zero lift' and describe how. [12+4]

8. (a) Derive an equation for the minimum level speed achievable by a reciprocating engine propeller driven low subonic airplane. Assume a constant parabolic drag polar and that the variation of the power as directly proportional to density ratio at altitude, but invariant with Mach number of flight.

(b) Discuss the variation of minimum level speed with wing loading and P/W ratio (specified at sea level), for the airplane.

(c) Obtain an equation for the absolute ceiling of the airplane. [8+4+4]

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